

**WHAT IS CLAIMED IS:**

1. A method of separating a polymer mixture, comprising:  
providing a mixture including polymeric components;  
5 adding to the mixture a particulate media for selectively mediating a triboelectric charging of the polymer mixture, the charging media including a polymeric material having a selected position within an electrostatic charging sequence, the charging media including a functional additive;  
triboelectrically charging the mixture with the media;  
10 separating two or more components of the polymer mixture according to the triboelectric charge; and  
recovering at least a portion of the particulate media using a recovery process, wherein the functional additive is selected for compatibility with the recovery process.
- 15 2. The method of claim 1, wherein:  
the recovery process is a magnetic recovery process; and  
the functional additive is a ferromagnetic material.
- 20 3. The method of claim 1, wherein:  
the recovery process is a color sorting process; and  
the functional additive is a colored material.
4. The method of claim 1, wherein;  
the recovery process is a density separation process; and  
25 the functional additive is a density augmenting material.
5. The method of claim 1, wherein:  
the recovery process is a separation process based on thickness or surface-to-mass ratio; and  
30 the functional additive is a foaming agent.

6. The method of claim 1, wherein:  
the recovery process includes the collection of a neutral middle fraction in a  
triboelectric separator; and  
the functional additive is a conductive material.

5

7. The method of claim 1, wherein:  
the recovering is performed before the separating.

10

8. The method of claim 1, wherein:  
the recovering is performed after the separating.

15

9. The method of claim 1, wherein:  
the functional additive is a conductive material; and  
the separating and recovering include passing the charged mixture and media through  
an electric field to cause the two or more components and the charging media to deflect in  
different amounts such that the media is separated from the two or more components.

20

10. A method of treating a polymer mixture to generate a polymeric product, comprising:  
providing a mixture including polymeric components;  
adding to the mixture a particulate media for selectively mediating a triboelectric  
charging of the polymer mixture, the charging media including a polymeric material having a  
selected position within an electrostatic charging sequence, the charging media including a  
compatibilizer, the compatibilizer being a material being capable of reducing interfacial  
energy in a target blend of one or more of the polymeric components and one or more  
incompatible polymers by preferentially concentrating at an interface between the one or  
more of the polymeric components and one or more incompatible polymers in the blend;  
triboelectrically charging the mixture with the media;  
separating the polymer mixture according to the triboelectric charge to generate a  
polymeric product including the target blend and an amount of the compatibilizer.

30

11. The method of claim 10, wherein:

the incompatible polymer is a polymeric component of the polymer mixture.

12. The method of claim 10, wherein:

the incompatible polymer is added to a separation product including the one or more  
5 of the polymeric components and the compatibilizer.

13. The method of claim 10, wherein:

the compatibilizer includes a material having an affinity for the one or more of the  
polymeric components and the incompatible polymer.

10

14. The method of claim 10, wherein:

the compatibilizer includes a copolymer of the one or more of the polymeric  
components and the incompatible polymer.

15 15. A system for separating a polymer mixture, the system comprising:

a particulate charging media for selectively mediating a triboelectric charging of a  
polymer mixture, the charging media including a polymeric material having a selected  
position within an electrostatic charging sequence;

a charging chamber for triboelectrically charging the polymer mixture and the  
20 charging media;

a separation chamber for separating two or more charged polymeric components of  
the polymer mixture according to the triboelectric charge; and

a media recovery device for recovering at least a portion of the charging media  
according to a media recovery process, wherein the charging media includes one or more  
25 polymeric materials suitable for selectively mediating the charging of the polymer mixture,  
the charging media further including one or more functional additives compatible with the  
media recovery process.

16. The system of claim 15, wherein:

the recovery process is a magnetic recovery process; and  
the functional additive is a ferromagnetic material.

30

17. The system of claim 15, wherein:  
the recovery process is a color sorting process; and  
the functional additive is a colored material.

5

18. The system of claim 15, wherein;  
the recovery process is a density separation process; and  
the functional additive is a density augmenting material.

10 19. The system of claim 15, wherein:  
the recovery process is a separation process based on thickness or surface-to-mass  
ratio; and  
the functional additive is a foaming agent.

15 20. The system of claim 15, wherein:  
the media recovery device includes a triboelectric separator that includes the  
separation chamber;  
the recovery process includes the collection of a neutral middle fraction in a  
triboelectric separator; and  
20 the functional additive is a conductive material.

21. The system of claim 15, wherein:  
the functional additive is a conductive material; and  
the separation chamber is configured to expose the charged mixture and media to an  
25 electric field to cause the two or more components and the charging media to deflect in  
different amounts such that the media is separated from the two or more components.

22. A method of preparing a media for use in separating a polymer mixture by  
triboelectric separation, the method comprising:  
30 selecting one or more polymeric materials to be used in a charging media in a  
triboelectric separation of a polymer mixture;

selecting one or more functional additives according to a media recovery process to be used in the triboelectric separation; and

combining the selected polymeric materials and the selected functional additives to generate a particulate media for use in the triboelectric separation.

5

23. The method of claim 22, wherein:  
the media recovery process is a magnetic recovery process; and  
the functional additive is a ferromagnetic material.

10 24. The method of claim 22, wherein:  
the media recovery process is a color sorting process; and  
the functional additive is a colored material.

25. The method of claim 22, wherein;  
15 the media recovery process is a density separation process; and  
the functional additive is a density augmenting material.

26. The method of claim 22, wherein:  
the media recovery process is a separation process based on thickness or surface-to-  
20 mass ratio; and  
the functional additive is a foaming agent.

27. The method of claim 22, wherein:  
the media recovery process includes the collection of a neutral middle fraction in a  
25 triboelectric separator; and  
the functional additive is a conductive material.

28. A system for separating a polymer mixture, the system comprising:  
a roll sorter having two rotatable cylinders for triboelectrically charging two or more  
30 polymeric components of the polymer mixture, the rotatable cylinders having a coating of  
material incorporating a charging media for selectively mediating a triboelectric charging of

the two or more components of the polymer mixture, the charging media including a polymeric material having a selected position within an electrostatic charging sequence; and a separation chamber for separating the two or more charged polymeric components of the polymer mixture based on a triboelectric charge.

5

29. The system of claim 28, wherein:  
the coating is a thin film incorporating the charging media.

10

30. The system of claim 28, wherein:  
the coating is a paint incorporating the charging media.

15

31. A method of separating a polymer mixture, comprising:  
providing a mixture including polymeric components;  
adding to the mixture a particulate media for selectively mediating a triboelectric charging of the polymer mixture, the charging media including a polymeric material having a selected position within an electrostatic charging sequence, the charging media including a conductive additive;  
electrically charging the media with a high voltage source;  
triboelectrically charging the mixture with the charged media; and  
20 separating two or more components of the polymer mixture according to the triboelectric charge.

20

32. The method of claim 31, further comprising:  
discharging the charged media after the triboelectric charging; and  
25 recovering the discharged media as a neutral fraction in a triboelectric separator.

25

33. A method of separating a polymer mixture, comprising:  
providing a mixture including polymeric components;  
adding to the mixture a particulate media for selectively mediating a triboelectric  
charging of the polymer mixture, the charging media including a polymeric material having a  
5 selected position within an electrostatic charging sequence, the charging media including a  
ferromagnetic additive;  
triboelectrically charging the mixture with the media; and  
separating two or more components of the polymer mixture according to the triboelectric  
charge.

10